WEST

Generate Collection Print

L12: Entry 31 of 73 File: USPT May 18, 1999

DOCUMENT-IDENTIFIER: US 5904969 A
TITLE: Optical data recording medium and manufacturing method thereof

Abstract Text (1):
A desired writable optical data recording medium has a transparent substrate 1 where a side wall of a recess is connected to a land surface by a curved surface. A data recording portion of a dye material may be placed only in recesses of a pre-formatted pattern on a transparent substrate, and a reflective layer may be formed on the data recording portion and on the exposed land area between neighboring recesses. The medium can show reflectivity of not less than 65% on reproduction and reduce the cost for manufacturing thereof.

Brief Summary Text (3):
The present invention relates to a writable optical data recording medium comprising a data recording layer composed of a dye material, and a manufacturing method therefor.

Brief Summary Text (5):
A writable optical data recording medium which has a data recording layer composed of a water-insoluble organic dye material and which produces an output signal conforming to the CD format in reproduction of its recorded data has been known. This type of recording medium is called as WO(write once) type CD (Compact Disk) and is disclosed in, for example, Japanese Laid-Open No.2-289,935 and U.S. Pat. No. 5,021,276. This WO type CD has a structure in which a data recording layer composed of a dye material, a metal reflective layer, and a protective layer of a UV curing type resin are successively formed on a surface having a pre-formatted pattern of a transparent substrate. In recording, a laser beam is irradiated through the transparent substrate to the recording layer to heat the dye material by virtue of the absorption of the laser light. The heat decomposes the dye material to change the optical property of the data recording layer, and causes deformation of the transparent substrate placed under the data recording layer. When the recorded data is reproduced, a low-powered laser beam, unaffecting the data recording layer, is irradiated to the recorded area along the tracks, and then a difference between intensities of the reflected lights from the recorded portion and unrecorded portion is detected.

Brief Summary Text (11):
In accordance with the first aspect of the invention, an optical data recording medium is provided, which comprises:

Brief Summary Text (16):
In order to manufacture the optical data recording medium of the first aspect of the invention, a method for manufacturing an optical data recording medium is provided which comprises the steps of:

Brief Summary Text (25):
In accordance with the second aspect of the invention, in order to overcome the above-mentioned inconvenience of the conventional arts in a different way, an optical data recording medium is provided, which comprises:

Brief Summary Text (30):
In order to manufacture the optical data recording medium of the second aspect of the invention, a method for manufacturing an optical data recording medium is provided

comprises the steps of:

Brief Summary Text (38):
In the above-mentioned optical data recording media, it is desirable that the ratio b/a of the width b of the land surface defined between neighboring recesses to the space a between the bottoms of neighboring recesses is not more that 0.9. By controlling the ratio b/a to not more than 0.9, interference between a light reflected from the bottom of the recess and a light reflected from the land portion can be reduced effectively. As a result, a reflectivity with the laser beam for reproduction increases.

Brief Summary Text (39):
In accordance with the third aspect of the invention, in order to overcome the above-mentioned inconvenience of the conventional arts in a different way, an optical data recording medium is provided, which comprises:

Brief Summary Text (44):
According to the third aspect of the invention, a dye material is filled only in the recesses like pits and grooves of pre-formatted pattern, but any dye layer is not substantially formed on the land area defined between the recesses. An aluminum reflective layer is formed on the surface of the dye material filled in the recesses of the pre-formatted pattern and the land area. Since the a part of the light for reproduction need not pass through the dye material to arrive at the reflective layer and directs to the detector, the light amount detected by the detector increases compared with the conventional WO type CD. Specifically, in reproduction of a signal, the spot of laser beam for reproduction having a diameter of about three times of the width of the groove is irradiated along the track of the WO type CD. Therefore, the amount of light arriving at the aluminum reflective layer increases and then the reflectivity increases in the WO type CD of the invention because the outside portion of the laser beam for reproduction is directly projected on the aluminum reflective layer when the center of the laser beam spot is set at the middle of the groove, or because the central portion of the laser beam for reproduction is directly projected on the aluminum reflective layer when the center of the laser beam for reproduction is set on the land area between the neighboring groove of the pre-formatted pattern. Accordingly, a WO type optical data recording medium having the reflectivity of more than 65% conforming to the CD Standard can be produced.

Brief Summary Text (45):
In order to manufacture the optical data recording medium of the third aspect of the invention, a method for manufacturing an optical data recording medium is provided which comprises preparing a transparent substrate on one surface of which recesses and lands are formed as a pre-formatted pattern; placing a dye material only in the recesses of the transparent substrate; and forming a reflective layer on the dye material filled in the recesses and the lands of the transparent substrate.

Brief Summary Text (46):
In the optical data recording medium according to the invention, it is preferred that the material of the reflective layer is one material selected from a group consisting of aluminum, copper and a polymer material produced by association of a di-carbocyanine dye dispersed vinyl resin solution.

Drawing Description Text (2):
FIG. 1 is an enlarged cross sectional view of a main part of an optical data recording medium of the first embodiment according to the present invention.

Drawing Description Text (3):
FIG. 2 is a top view of an optical data recording medium of the first embodiment according to the present invention.

Drawing Description Text (4):
FIG. 3 is an enlarged cross sectional view of a main part of an optical data recording medium of the second embodiment according to the present invention.

Drawing Description Text (5):
FIG. 4 is an enlarged cross sectional view of a main part of an optical data

recording medium of the third embodiment according to the present invention.

Drawing Description Text (6):
FIG. 5 is an enlarged cross sectional view of a main part of an optical data recording medium of the fourth embodiment according to the present invention.

Drawing Description Text (7):
FIG. 6 is a top view of an optical data recording medium of the fifth embodiment according to the present invention.

Drawing Description Text (8):
FIG. 7 is an enlarged cross sectional view of a main part of an optical data recording medium of the sixth embodiment according to the present invention.

Drawing Description Text (9):
FIG. 8 is a flowchart showing the manufacturing processes of an optical data recording medium of the sixth embodiment according to the present invention.

Drawing Description Text (10):
FIG. 9 is a flowchart showing the processes for forming the recording layer in an optical data recording medium of the first embodiment according to the present invention.

Drawing Description Text (11):
FIG. 10 is an enlarged cross sectional view of a main part of an optical data recording medium of the seventh embodiment according to the present invention.

Detailed Description Text (4):
An optical data recording medium of the first embodiment will be described based on FIG. 1 and FIG. 2. FIG. 1 is an enlarged cross sectional view of a main part of an optical data recording medium of the first embodiment and FIG. 2 is a top view of the optical data recording medium of the first embodiment. As shown in these drawings, the optical data recording medium of the first embodiment is composed of a transparent substrate 1 on one surface of which a pre-formatted pattern 2 is formed as a fine irregular surface, a data recording portion 3 filled with a dye material in the pre-formatted pattern 2, a reflective layer 4 laid on the data recording portion 3 and the exposed surface (land surface) of the transparent substrate 1 between the data recording portions 3, and a protective layer 5 coated on the reflective layer.

Detailed Description Text (5):
As the transparent substrate 1, any types of the known transparent substrates can be used for the present invention. For example, a transparent substrate having a desired pre-formatted pattern by an injection molding of a transparent resin material such as polycarbonate, polymethyl methacrylate, polymethyl pentene, and epoxy resin. And, a transparent substrate formed by adhering a transparent resin film with a transferred desired pre-formatted pattern to a transparent ceramic disk such as a glass plate and the like can be used. A transparent substrate 1 which a disk-like optical data recording medium (hereinafter, referred to as an optical disk) is composed of, is formed as a disk having a central hole 1a in its central portion as shown in FIG. 2. Further, the method for manufacturing the transparent substrate 1 belongs to the conventional arts and does not constitute the essential points in the present invention, and the explanation thereof has been omitted.

Detailed Description Text (10):
The reflective layer can be formed using organic materials having high reflectivity besides metal materials such as aluminum, silver, copper, and the like, or metal alloys containing the above-mentioned metal materials as their main components. One example of the reflective layer using organic materials is an associated material formed by spin-coating a di-carbocyanine dye dispersed vinyl resin solution on a transparent substrate 1 and heat-treatment (for example, at 80 centigrade for 3 hours) of the substrate 1. Among these reflective materials, aluminum is particularly suitable because it is low-cost and has the results of actual use in compact disks. When metals or metal alloy materials are used for a reflective layer, the reflective layer 4 can be formed by a method of making a film in vacuum such as sputtering, vacuum evaporation, and the like. In this case, a technique to enhance the

reflectivity of those metal reflective layers by forming films having different densities by means of sputtering under a high degree of vacuum (for example, around 10.sup.-5 Torr) in the vacuum chamber can be used.

Detailed Description Text (15):
An acrylic resin containing 20 weight % of a phthalocyanine dye and 20 weight % of a cyanine respectively dispersed in the acrylic resin was used to form the data recording portion on a pre-formatted pattern of a polycarbonate substrate shown in FIGS. 1 and 2. Next, a di-carbocyanine dye dispersed vinyl resin solution was spin-coated on the surface having a pre-formatted pattern of the polycarbonate substrate. And then the substrate was heated at 80 centigrade for 3 hours to form an associated material as a reflective layer. Finally, a UV-curing resin as a protective layer was applied on the reflective layer to finish a product of an optical data recording medium.

Detailed Description Text (16):
The obtained optical data recording medium was loaded into a drive system (an analyzer for CD-R: PULSE TECH CORPORATION, DDU-1000: .lambda.=780 nm) which conforms to the CD Standard. When test data (random EFM signals) were recorded on the data recording medium and reproduced therefrom by the drive system, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproducing light measured not less than 65%.

Detailed Description Text (19):
A data recording portion was formed using a dye material of acrylic resin containing 20 weight % of a naphthalocyanine dye and a cyanine dye each dispersed in the acrylic resin. Other conditions to produce an optical recording medium were the same as those in the experimental example 1-(1).

Detailed Description Text (20):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent receding and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (22):
A data recording portion was formed using a dye material of acrylic resin containing 20 weight % of a naphthalocyanine dye and a phthalocyanine dye each dispersed in the acrylic resin. Other condition for producing an optical recording medium were the same as those in the example 1-(1).

Detailed Description Text (23):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (25):
Optical data recording media corresponding to the examples 1-(1) to 1-(3) were produced in the same way in these examples except an associated material made from a phthalocyanine dye dispersed vinyl resin solution was used as the reflective layer.

Detailed Description Text (26):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (28):
A data recording portion was formed on a polycarbonate substrate having the pre-formatted pattern shown in FIGS. 1 and 2 using an ethylcellosolve solution of a cyanine dye having its main absorption in the region of wavelength of 650 nm to 750 nm. Next, a reflective layer was formed by sputtering aluminum on the surface having the pre-formatted pattern of the polycarbonate substrate. Finally, an optical data recording medium was completed by applying a protective layer of a UV-curing resin on

the aluminum reflective layer.

Detailed Description Text (29):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (31):
A data recording portion was formed using an ethylcellosolve solution of a phthalocyanine dye showing its main absorption in the region of wavelength of 650 nm to 750 nm. Other condition for producing an optical recording medium were the same as those in the example 1-(5).

Detailed Description Text (32):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (34):
A data recording portion was formed using an ethylcellosolve solution of a mixture of a cyanine dye and a phthalocyanine dye showing its main absorption in the region of wavelength of 650 nm to 750 nm. Other conditions for producing an optical recording medium were the same as those in the example of 1-(5).

Detailed Description Text (35):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (37):
A data recording portion was formed using an ethylcellosolve solution of a polymethyne dye showing its main absorption in the region of wavelength of 650 nm to 750 nm. Other conditions for producing an optical recording medium were the same as those in the example of 1-(5).

Detailed Description Text (38):
When the obtained optical recording medium of the present example was loaded into the drive system used in Example 1-(1) to record test data (random EFM signals) and reproduce it, excellent recording and reproducing characteristics were obtained. The reflectivity of the reproduction light from the medium measured not less than 65%.

Detailed Description Text (40):
A data recording portion was formed on using an ethylcellosolve solution of a polycarbonate substrate having the pre-formatted pattern shown in FIGS. 1 and 2 using a cyanine dye having its main absorption in the region of wavelength of 550 nm to 650 nm. Next, a reflective layer was formed by sputtering aluminum on the surface having the pre-formatted pattern of the polycarbonate substrate. Finally, an optical data recording medium was completed by applying a protective layer of a UV-curing resin on the aluminum reflective layer.

Detailed Description Text (41):
An optical recording medium of the present experimental example was loaded into a drive system using a laser beam of a wavelength of 650 nm as its recording and reproducing light. When a test data were recorded in the medium and reproduced therefrom, excellent recording and reproducing characteristics were obtained.

Detailed Description Text (43):
A data recording portion was formed using an ethylcellosolve solution of a phthalocyanine dye showing its main absorption in the region of wavelength of 550 nm to 650 nm. Other condition for producing an optical recording medium were the same as those in the example 1-5.

Detailed Description Text (44):
An optical recording medium of the present experimental example was loaded into a drive system having a 650 nm laser beam for recording and reproducing. When test data were recorded on the medium and reproduced therefrom, excellent recording and reproducing characteristics were obtained.

Detailed Description Text (46):
A data recording portion was formed using an ethylcellosolve solution of a cyanine dye and a phthalocyanine dye showing its main absorption in the region of wavelength of 550 nm to 650 nm. Other conditions for producing an optical recording medium were the same as those in the example of 1-(5).

Detailed Description Text (47):
An optical recording medium of the present experimental example was loaded into a drive system having a 650 nm laser beam for recording and reproducing. When test data were recorded on the medium and reproduced therefrom, excellent recording and reproducing characteristics were obtained.

Detailed Description Text (49):
A data recording portion was formed using an ethylcellosolve solution of a polymethyne dye showing its main absorption in the region of wavelength of 550 nm to 650 nm. Other conditions for producing an optical recording medium were the same as those in the example of 1-(5).

Detailed Description Text (50):
When an optical recording medium of the present experimental example was loaded into a drive system having a 650 nm laser beam for recording and reproducing. When test data were recorded on the medium and reproduced therefrom, excellent recording and reproducing characteristics were obtained.

Detailed Description Text (52):
An optical data recording medium of a second embodiment will be described based on FIG. 3. FIG. 3 is an enlarged cross sectional view of a main part of the optical data recording medium of the second embodiment. As shown in the drawing, the optical data recording medium is characterized by an undercoat layer 6 formed on the surface having a pre-formatted pattern of a transparent substrate 1. A data recording portion 3 was formed by filling a dye material in the grooves 2a and pre-pits 2b of the pre-formatted pattern 2 formed on the surface of the undercoat layer 6. A reflective layer was formed on the data recording portion 3 and on the exposed surface of the undercoat layer between neighboring data recording portions 3. A protective layer 5 was coated on the reflective layer 4.

Detailed Description Text (67):
Various kinds of optical data recording media according to the second embodiment were produced using various dye materials as used in the first embodiment for a data recording portion and using various materials as used in the first embodiment for reflective layers. They were loaded in the drive system, used in the first embodiment, conforming to The CD Standard. When test data (random EMFsignals) were recorded on these media and reproduced therefrom, excellent recording and reproducing characteristics were obtained in the respective data recording optical media. The reflectivities of the reproducing light measured not less than 65%.

Detailed Description Text (69):
An optical data recording medium according to a third embodiment will be explained based on FIG. 4. FIG. 4 is an enlarged cross sectional view of a main part of an optical data recording medium of the third embodiment. As clearly seen in the drawing, the optical data recording medium of the third embodiment is characterized in that a reflective layer 4 was laid through an intermediate layer 7 on the surface of a data recording portion 3 which was formed by filling a dye in a pre-formatted pattern and on the exposed surface between the neighboring data recording portions 3 of a transparent substrate 1. A protective layer 5 was coated on the reflective layer 4.

Detailed Description Text (72):
Various kinds of optical data recording media according to the third embodiment were

produced using various dye materials as used in the first embodiment for a data recording portion and various material as used in the first embodiment for reflective layers. These obtained media were loaded in the drive system, used in the first embodiment, conforming to the CD Standard. When test data were recorded in the media and reproduced therefrom, excellent recording and reproducing characteristics were obtained in the respective media. The reflectivity of the reproducing light measured not less than 65%.

Detailed Description Text (75):
An optical data recording medium according to a fourth embodiment is explained based on FIG. 5. FIG. 5 is an enlarged cross sectional view of a main part of an optical data recording medium according to the fourth embodiment. As clearly seen in the drawing, the optical data recording medium is characterized in that a printed layer 8 is applied on the surface of a protective layer 5.

Detailed Description Text (77):
These optical data recording media according to the fourth embodiment were loaded into the drive system conforming to the CD Standard, used in the first embodiment. When test data were recorded on the media and reproduced therefrom, excellent recording and reproducing characteristics were obtained. Further, although in this embodiment (FIG. 5) a printed layer was formed on the optical data recording medium according to the first embodiment (FIG. 1), the printed layer was formed on an optical data recording medium according to the second embodiment and the third embodiment respectively. In respective media with the printed layer, the same excellent performance in terms of recording and reproducing as those without the printed layer was obtained.

Detailed Description Text (79):
An optical data recording medium according to a fifth embodiment is explained based on FIG. 6. FIG. 6 is a plan view of the optical recording medium according to the fifth embodiment. As clearly seen in the drawing, the optical recording medium according to the present embodiment is characterized by an optical data recording medium having a data recording area divided into a ROM area 11a and a writable area 11b, or a so-called partial ROM type optical data recording medium to which the present invention is applied.

Detailed Description Text (81):
Further, the writable area 11b can be constructed in the same way as the optical data recording medium according to the first embodiment, the second embodiment, or the third embodiment. Also, a printed layer can be formed on the outside surface of a protective layer as shown in FIG. 5.

Detailed Description Text (83):
The writable area 11b of the optical data recording medium according to the fifth embodiment was confirmed to have the same excellent recording and reproducing characteristics as the above-mentioned embodiments. Further, the ROM area 11a was confirmed to have excellent reproducing characteristics when used on a drive system conforming to the CD Standard.

Detailed Description Text (85):
An optical data recording medium according to a sixth embodiment is explained based on FIG. 7 through FIG. 8. FIG. 7 is a cross sectional view of the optical data recording medium according to the sixth embodiment, and FIG. 8 is flowchart of manufacturing processes for the optical recording medium according to the sixth embodiment. As shown in FIG. 7, the optical data recording medium according to the sixth embodiment is characterized in that a side wall 76 of a groove 2a and a side wall 70 of a pre-pit 2b are connected with a land surface 72 of land area 2c by a curved surfaces 78 and 74 respectively.

Detailed Description Text (86):
As shown in FIG. 1, FIG. 3, FIG. 4, and FIG. 5, the optical data recording medium according to the first through the fifth embodiment has a boundary between the guide groove 2a and the land area 2c and a boundary between the pre-pit 2b and the land area 2c both of which are sharp-edged. However, the optical data recording medium according to the sixth embodiment is structured so that each boundary has a curved

surface as shown in FIG. 7 in order to decrease interference between the light reflected from the land surface and the bottom 75. In accordance with the structure of the pre-formatted pattern where the side walls of recesses like grooves 2a and pre-pits 2b are connected with the respective land surfaces by curved surfaces, a reflectivity of not less than 65% with laser beam for reproduction can be easily obtained. Further, in this embodiment, the dye material was filled not only in the recesses including the groove 2a and the pre-pit 2b, but also placed as a thin data recording layer 80 between the substrate 1 and reflective layer 4. However, the structure of the optical recording media described in the first to fifth embodiments where the dye material existed only in the recesses of the pre-formatted pattern may be applied to the present embodiment as shown in FIG. 7.

Detailed Description Text (88):
The manufacturing processes of the optical data recording medium according to the sixth embodiment is shown in the flowchart of FIG. 8.

Detailed Description Text (89):
In the first stage (S1), a glass disk is cleaned by an appropriate solvent or other method. Then, a silane solution as an adhesive accelerator and a photoresist are spin-coated respectively on the glass disk (S2,S3). In the fourth stage (S4), the glass disk is prebaked and then the glass disk with photoresist is exposed to a laser beam in accordance with a certain pre-formatted pattern thereon (S5:cutting). After developing the exposed glass disk (S6), it is subjected to the first bake treatment (S7) which is one process used in a conventional technique for manufacturing the transparent substrate. Then, in the second bake treatment (S8), the grass disk is heated over the glass transition temperature of the photo-resist to deform the pre-formatted pattern developed in the stage S6. This deformation by the heating provides the specific structure of the photoresist where a boundary between the guide groove 2a and the land area 2c and a boundary between the pre-pit 2b and the land area 2c are in the form of curved surfaces. After this stage (S8), the conventional processes as shown in FIG. 8 (steps S9-S20) are carried out for making an optical data recording medium

Detailed Description Text (90):
The optical data recording medium according to the sixth embodiment with the boundary between the guide groove 2a and the land area 2c and the boundary between the pre-pit 2b and the land area 2c both of which have a curved surface can reduce the interference of light at the boundary between the bottom surface of the pre-formatted pattern 2 and the land area 2c of the transparent substrate 1 compared with the boundaries of a sharp edge. Consequently, even if the material having a less reflectivity than pure silver are used to form a reflective layer 4, the reflectivity of not less than 65%.

Detailed Description Text (92):
An optical data recording medium according to a seventh embodiment is explained based on FIGS. 10 and 11. FIG. 10 is a cross sectional view of a main part of the optical data recording medium according to the seventh embodiment. As shown in FIG. 10, the optical data recording medium is characterized in that a portion 2d corresponding to one edge (left side edge in FIG. 10) of the land area 2c is projected from the land surface in the thickness direction of the transparent substrate. The portion 2d also corresponds to a boundary between the side wall 70 (left side wall in FIG. 10) of the pre-pit 2b and a surface of the land area 2c formed.

Detailed Description Text (93):
FIG. 11 is a conceptional view showing the structure of the guide groove 2a and the projecting portion 2d of the optical data recording medium according to the seventh embodiment. In FIG. 11, the pre-pits 2b and the dye material 3 are not shown for the purpose of simply explaining the structural relationship between the projecting portion 2d and the guide groove 2a. The projecting portion 2d is formed on the left side edge of the land portion 2c and extends linearly along the groove 2a.

Detailed Description Text (94):
Although, as shown in FIG. 1, FIG. 3, FIG. 4, and FIG. 5, the optical data recording media according to the first through the fifth embodiments have a flat surface of the land portion 2c, the optical data recording medium according to the seventh

embodiment has the linear projected portion 2d from the land surface in the direction of the thickness of the transparent substrate 1 at the boundary between the recess (groove 2a, pre-pit 2b) and the land portion 2c. Also, in the case of the seventh embodiment, it is preferred that the ratio b/a of a width b of the land area (without the area of the projecting portion 2d) to a distance a between the bottoms of neighboring pre-pits 2b in the pre-formatted pattern is not more than 90%.

Detailed Description Text (95):
The linear projected portion 2d can be formed by opening the molding die and removing the transparent substrate from the stamper in the step S11 shown in FIG. 8 after the resin was injected into the die with the stamper therein, but before the resin has been completely hardened. The other steps for manufacturing the optical recording medium according to the present embodiment has the same steps shown in the sixth embodiment and FIG. 8 except the step of the second bake (S8) was not carried out.

Detailed Description Text (96):
The optical data recording medium according to the present embodiment has the linear projected portion in the thickness direction of the transparent substrate formed at the boundary between the recesses of pre-formatted pattern 2 and the land area 2c, and the interference of light is reduced at the boundary. Consequently, even if the reflective materials having less reflectivity than pure silver is used to form a reflective layer 4, the reflectivity of more than 65% can be obtained.

Detailed Description Text (97):
Further, the above-mentioned embodiments were explained using disk-like recording media, but the essential points of the present invention is not limited only to the disk-like recording media, but can be applied to optical data recording media of other forms such as card-like or tape-like media.

Detailed Description Text (98):
As mentioned above, as the present invention enables the production of an optical data recording medium such as writable CDs requiring, for example, a reflectivity of more than 65% using low-cost materials like aluminum for the reflective layer, the production cost of such optical data recording can be reduced. Further, as the manufacturing method of an optical data recording medium according to the present invention enables the production of writable optical data recording media of a high reflectivity provided with a low-cost and corrosion resisting reflective layer composed of aluminum and the like, such optical data recording media can be produced at a low cost.

Detailed Description Text (99):
Although the reproduction light of the wavelength .lambda.=650 nm was used in Examples 1-(9).about.1-(12) of the first Embodiment, an wavelength selected from the range of 630.about.670 nm may be used instead of .lambda.=650 nm to reproduce the optical recording media obtained in these Examples.

CLAIMS:

1. An optical data recording medium comprising:

a transparent substrate formed by molding such that recesses and lands are formed on one surface of the substrate as a pre-formatted pattern and a portion connecting a side wall of a recess with a land surface defined by the recess is formed as a curved surface;

a data recording layer comprised of a dye material and formed on the one surface of the transparent substrate and;

a reflective layer comprised of a material having a lower reflectivity than silver and formed on the data recording layer, wherein the data recording layer exists only in the recesses of the transparent substrate.

2. An optical data recording medium according to claim 1, wherein a ratio b/a of a width b of the land surface defined between neighboring recesses to a distance a between the bottoms of the neighboring recesses is not more than 0.9.

3. An optical data recording medium according to claim 1, wherein the optical data recording medium has a reflectivity of more than 65% with a laser beam for reproduction.

4. An optical data recording medium according to claim 1, wherein the material of the reflective layer is one material selected from a group consisting of aluminum, copper and a polymer material produced by association of a dicarbocyanine dye dispersed vinyl resin solution.

5. An optical data recording medium according to claim 1, wherein the material of the reflective layer is aluminum.

6. An optical data recording medium comprising:

a transparent substrate formed by molding such that recesses and lands are formed as a pre-formatted pattern and a portion connecting a side wall of a recess with a land surface defined by the recess is projected from the land surface in a direction of the thickness of the transparent substrate;

a data recording layer comprised of a dye material and formed on the one surface of the transparent substrate and;

a reflective layer comprised of a material having a lower reflectivity than silver and formed on the data recording layer,

wherein the data recording layer exists only in the recesses of the transparent substrate.

7. An optical data recording medium according to claim 6, wherein a ratio b/a of a width b of the land defined between neighboring recesses to a distance between the bottoms of the neighboring recesses is not more than 0.9.

8. An optical data recording medium according to claim 6, wherein the optical data recording medium has a reflectivity of more than 65% with a laser beam for reproduction.

9. An optical data recording medium according to claim 6, wherein the material of the reflective layer is one material selected from a group consisting of aluminum, copper and a polymer material produced by association of a dicarbocyanine dye dispersed vinyl resin solution.

10. An optical data recording medium according to claim 6, wherein the material of the reflective layer is aluminum.

11. An optical data recording medium comprising:

a transparent substrate on one surface of which recesses and lands are formed as pre-formatted pattern;

a reflective layer comprised of a material having a lower reflectivity than silver and formed on the one surface of the transparent substrate;

a data recording portion comprising a dye material, which is formed only in the recesses of the transparent substrate.

12. An optical data recording medium according to claim 11, wherein the optical data recording medium has a reflectivity of more than 65% with a laser beam for reproduction.

13. An optical data recording medium according to claim 11, wherein the material of the reflective layer is one material selected from a group consisting of aluminum, copper and a polymer material produced by association of a dicarbocyanine dye dispersed vinyl resin solution.

14. An optical data recording medium according to claim 11, wherein the material of the reflective layer is aluminum.

15. An optical data recording medium according to claim 11, wherein the dye material is at least one materials selected from a group consisting of dicarbocyanine derivative, a phthalocyanine derivative, a naphthalocyanine derivative, and a cyanine derivative.

16. An optical data recording medium according to claim 11, wherein the transparent substrate is a substrate formed by molding such that a portion connecting a side wall of a recess with a land surface defined by the recess is formed as a curved surface.

17. An optical data recording medium according to claim 11, wherein the transparent substrate is a substrate formed by molding such that a portion connecting a side wall of a recess with a land surface defined by the recess is projected from the land surface in a direction of the thickness of the transparent substrate.

18. A method for manufacturing an optical data recording medium comprising:

preparing a transparent substrate on one surface of which recesses and lands are formed as a pre-formatted pattern;

placing a dye material only in the recesses of the transparent substrate;

forming a reflective layer on the dye material filled in the recesses and the lands of the transparent substrate.

19. A method for manufacturing an optical data recording medium according to claim 18, wherein the dye material is filled only in the recesses by spin-coating a solution of the dye material on the one surface of the transparent substrate and selectively removing the dye material deposited on the lands between the recesses so as to expose the surface of the lands.

20. A method for manufacturing an optical data recording medium according to claim 19, wherein the dye material deposited on the lands is selectively removed by spin-coating a solvent on the one surface after spin-coating of the solution of the dye material.

WEST

Generate Collection | Print

L12: Entry 33 of 73 File: USPT Jul 28, 1998

DOCUMENT-IDENTIFIER: US 5786078 A
TITLE: Magneto-optical recording medium

Abstract Text (1):
A magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first dielectric layer and a metal reflecting layer on the magneto-optical recording layer, optically with a second dielecric layer between the magneto-optical recording layer, wherein the magneto-optical recording layer has a Curie temperature Tc of from 100.degree. C. to 200.degree. C. and a layer thickness of from 15 nm to 60 nm, the metal reflecting layer has a layer thickness of not less than 60 nm and a product .lambda.d of a thermal conductivity .lambda. by the layer thickness d of from 2.5 .mu.W/K to 20 .mu.W/K, and the following formula is satisfied: Tc.ltoreq.-10.times..lambda.d+300. This magneto-optical recording medium has an improved stability under repeated recording and erasing, or continuous erasing, operations without a loss of a high recording sensitivity thereof.

Brief Summary Text (3):
The present invention relates to a magneto-optical recording medium in which information is recorded, reproduced and erased by a light such as a laser beam. More specifically, the present invention relates to a magneto-optical recording medium comprising a magneto-optical recording layer of a rare-earth and transition metal elements alloy or the like having a low Curie temperature, and a metal reflecting layer having a high thermal conductivity and/or a thick thickness and having a high recording sensitivity and in particular, an excellent resistance to repeated recording and erasing or to a continuous erasing.

Brief Summary Text (5):
Magneto-optical recording mediums are in practical use as high density and high capacity information storage mediums, and particularly, various materials and systems have been proposed for information-erasable magneto-optical recording mediums having various fields of application.

Brief Summary Text (6):
A magneto-optical recording medium equivalent to a medium proposed in the prior art is a disc comprising a polycarbonate resin (PC) substrate having a thickness of 1.2 mm / a first transparent dielectric layer of AlSiN having a thickness of 110 nm / a magneto-optical recording layer of TbFeCo having a thickness of 22.5 nm / a second transparent dielectric layer of AlSiN having a thickness of 25 nm / a metal reflecting layer of AlTi having a thickness of 40 nm / and a protecting organic layer of an UV-curable resin having a thickness of 20 .mu.m and a diameter of 130 mm.

Brief Summary Text (7):
The present inventors carried out the following evaluation of a magneto-optical recording medium having the same construction as that of the above magneto-optical recording medium: On a track having a diameter of 30 mm, a recording was made under the conditions of a disc rotation speed of 1800 r.p.m., a recording frequency of 3.7 MH.sub.z (pulse duty of 33%), an external magnetic field of 24 kA/m (300 Oe) and a recording laser power of 5.5 mW (the value at which the C/N reaches the maximum value), and then a laser beam having a power of 9 mW was continuously irradiated on the same track as above until a predetermined number of rotations was reached, to test the continuous erasing resistance. The above predetermined number of rotations

was made 10.sup.7, as it is generally considered necessary to maintain a C/N of 45 dB or more after 10.sup.7 rotations. After the continuous erasing resistance test, the C/N was measured by conducting a recording under the same conditions as above, and a reproduction, and as a result, it was found that initial C/N was 48 dB, and that the C/N was reduced by 2 dB to 46 dB after 10.sup.3 rotations in a continuous erasing operation, and by 8 dB to 40 dB after 10.sup.7 rotations in a continuous erasing operation, and accordingly, the magneto-optical recording medium did not satisfy the criteria of a C/N of not less than 45 dB after 10.sup.7 rotations.

Brief Summary Text (8):
Namely, it was shown that the magneto-optical recording medium suffers a thermal deterioration of the magneto-optical recording layer when subjected to a repeated recording and erasing, because the medium is recorded and erased by heat from a laser beam. In particular, erasing is performed with a laser beam having a high power such that the temperature of the recording layer is considered to be raised to above 500.degree. C., to thereby cause a remarkable deterioration of the recording layer when continuously erasing an identical track. Thus, for a rewritable magneto-optical recording medium, the problem of a deterioration of the performance of a magneto-optical recording medium due to a repeated recording and erasing, or a continuous erasing, of tracks must be solved.

Brief Summary Text (9):
Therefore, the object of the present invention is to provide a magneto-optical recording medium having a sufficient resistance to a repeated recording and erasing, or to a continuous erasing of tracks.

Brief Summary Text (11):
The above object of the present invention is attained by a magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first dielectric layer, and a metal reflecting layer on the magneto-optical recording layer, optionally with a second dielectric layer between the magneto-optical recording layer and the metal reflecting layer, wherein said magneto-optical recording layer has a Curie temperature Tc of from 100.degree. C. to 200.degree. C. (100.ltoreq.Tc.ltoreq.200) and a layer thickness t of from 15 nm to 60 nm (15.ltoreq.t.ltoreq.60), the metal reflecting layer has a layer thickness d of not less than 60 nm, and a product .lambda.d of a thermal conductivity .lambda. by the layer thickness d of from 2.5 .mu.W/K to 20 .mu.W/K (2.5.ltoreq..lambda.d.ltoreq.20), whereby the following formula is satisfied: Tc.ltoreq.-10.times..lambda.d+300.

Brief Summary Text (12):
As described above, the present inventors tested the continuous erasing stability of a magneto-optical recording medium having a construction equivalent to that of a medium proposed in the prior art, and found that the C/N of the medium was remarkably reduced after 10.sup.7 rotations. The reason for this is considered to be that the recording layer is thermally deteriorated by an elevation of the temperature due to an irradiation of a laser during the continuous erasing stability test. Namely, a temperature of the amorphous rare-earth and transition metal alloy of the medium is raised to above 500.degree. C. during the erasing, and therefore, a relaxation of the amorphous structure, a crystallization, an oxidization, and a nitrization, etc. of the magneto-optical recording layer occur, to thereby deteriorate the magneto-optical characteristics and lower the C/N of the medium.

Brief Summary Text (13):
Accordingly, the present inventors sought ways in which to prevent the temperature elevation of the recording layer, and found that an increase of the .lambda.d of a metal reflecting layer behind the recording layer, i.e., a selection of a material for the reflecting layer having a high thermal conductivity, and/or a thickening of the reflecting layer, is a most effective measure. Nevertheless, although this method allowed a prevention of the raising of the temperature of the recording layer, it caused a lowering of the sensitivity of the medium and required a high laser power for recording.

Brief Summary Text (14):
Accordingly, the present inventors then considered that a magneto-optical recording

layer having a lower Curie temperature Tc would effectively obtain a necessary recording sensitivity with a recording laser power comparative to that for the magneto-optical recording medium proposed in the prior art, and thus evaluated a magneto-optical recording disc having the following construction: the disc comprised a PC substrate (1.2 mm) an AlSiN layer (110 nm) / a TbFeCo layer (22.5 nm) / an AlSiN layer (25 nm) / an AlTi layer (80 nm) / a protecting organic layer of UV-curable resin (20 .mu.m), and had a diameter of 130 mm, in which the metal reflecting layer had a thickness double that of the medium proposed in the prior art, and the magneto-optical recording layer had a Curie temperature of about 190.degree. C. A test of the continuous erasing stability as above, at an erasing power of 9 mW, was performed on this disc, and surprisingly, an excellent result of C/N.gtoreq.45 dB after 10.sup.7 rotations was obtained. The C/N reached a maximum value at a laser power of 5.5 mW, and thus the recording sensitivity was comparable to that of the commercially available magneto-optical recording medium. This was considered to be because the thickness of the reflecting layer was increased from 40 nm to 80 nm, to thereby increase the .lambda.d corresponding to the heat sink characteristic of a spot of the recording layer heated by a laser, and remarkably prevent an elevation of the temperature of the recording layer.

Brief Summary Text (15):
Further, a magneto-optical recording medium having the following construction was made: a PC substrate (1.2 mm) / an AlSiN layer (110 nm) / a NdDyTbFeCo layer (22.5 nm) / an AlSiN layer (25 nm) / an AlTi layer (100 nm) / a protecting organic layer of an UV-curable resin (20 .mu.m), and having a diameter of 130 mm, the metal reflecting layer having a thickness of 100 nm, more than double that of the medium proposed in the prior art, and the magneto-optical recording layer having a Curie temperature of about 150.degree. C. A test of the continuous erasing stability as above, at an erasing power of 8.5 mW, was performed on this disc, and surprisingly, excellent results of a lowering of the C/N by less than 1 dB after 10.sup.6 rotations, and a lowering of the C/N by about 1.5 dB and a C/N of 45.5 dB after 10.sup.7 rotations were obtained. The C/N reached a maximum value at a laser power of 5.0 mW, and thus the recording sensitivity was superior to that of the magneto-optical recording medium proposed in the prior art. Such a highly sensitive medium is preferred for a high speed drive at 2400 rpm or 3600 rpm or more, as at a high rotation speed, a temperature elevation of the recording layer is smaller than that at a lower rotation speed, even at the same laser power, and this is preferable from the viewpoint of the stability of the medium. Therefore, a medium more sensitive than the present standard can be evaluated under milder conditions, i.e., at an erasing power of 8.5 mW or at a higher rotation speed. The present invention adopted the former condition, and mediums which reached a maximum C/N value at 5.0 mW were evaluated at an erasing power of 8.5 mW. Similarly, mediums which reached a maximum C/N value at 4.5 mW, as described later, were evaluated at an erasing power of 8.0 mW.

Drawing Description Text (2):
FIGS. 1 and 2 are sectional views of magneto-optical mediums made in Examples and Comparative examples; and

Detailed Description Text (5):
When the medium construction and the thicknesses of the layers are the same, the recording sensitivity of the medium is mainly determined by a combination of Tc and .lambda.d. A combination of a low Tc and a small .lambda.d provides a highly sensitive medium which can be adopted to a high speed drive. Also, the recording sensitivity of a medium can be controlled by the thicknesses of the dielectric layers and the recording layer. When considering the requirements of the drive, such as a medium reflectance and C/N value, it is concluded that if Tc and .lambda.d are within the range of the present invention, magneto-optical recording mediums having a recording sensitivity and an erasing stability adapted to current and future magneto-optical recording drives can be obtained.

Detailed Description Text (6):
The Curie temperature Tc of the magneto-optical recording layer should be not lower than 100.degree. C. (Tc.gtoreq.100) preferably not lower than 110.degree. C. (Tc.gtoreq.110), since a high temperature and high humidity stability test of a magneto-optical recording medium is carried out at 80.degree. C. and 85% RH. Also, the Curie temperature Tc of the magneto-optical recording layer should be not higher

than 200.degree. C. (Tc.ltoreq.200), from the above-mentioned reason. Further not only for a C/N value of not lower than 45 dB after 10.sup.7 rotations but also a lesser lowering of the C/N value after 10.sup.7 rotations, the Curie temperature Tc of the magneto-optical recording layer is preferably not higher than 180.degree. C. (Tc.ltoreq.180), more preferably not higher than 160.degree. C. (Tc.ltoreq.160).

Detailed Description Text (9):
The relative thickness between the first and second magnetic layers is preferably t.sub.1 <t.sub.2, where t.sub.1 denotes the thickness of the first magnetic layer and t.sub.2 denotes the thickness of the second magnetic layer. If t.sub.1 .gtoreq.t.sub.2, i.e., t.sub.2 is too thin, the magnetization of the first magnetic layer cannot be maintained even if the coercive force Hc.sub.2 of the second magnetic layer is larger than the coercive force Hc.sub.1 of the first magnetic layer, i.e., Hc.sub.2 >Hc.sub.1. As a result, a C/N value of the medium may be lower than that of a medium having a magneto-optical recording layer composed of a single magnetic layer. If the first magnetic layer is too thin, however, it is difficult to form a layer exhibiting good magnetic characteristics, and the formed layer is not stable. Therefore, the first magnetic layer preferably has a thickness of not less than 10 nm and thus 10.ltoreq.t.sub.1 <(t.sub.1 +t.sub.2) / 2.

Detailed Description Text (10):
A magneto-optical recording medium of the present invention is characterized in that the Faraday effect is also utilized by passing a laser through the recording layer. Nevertheless, the present invention can be applied to an exchange coupled complex layer in which the construction of the first and second magnetic layers is reversed. Further, a layer for controlling the exchange coupling force may be inserted between the first and second magnetic layers.

Detailed Description Text (14):
In the present invention, if the magneto-optical recording layer has a relatively high Curie temperature, it is impossible to use a metal reflecting layer having a high .lambda.d value, to obtain a sensitivity equivalent to the medium used in the experiment, or higher than that, considering use at a higher rotation speed, Therefore, it was found from experiments that it is generally necessary to satisfy Tc.ltoreq.-10.times..lambda.d+300, and for a more sensitive magneto-optical recording medium, preferably Tc.ltoreq.-10.times..lambda.d+240. (FIG. 3, made from the results of Examples and Comparative examples, shows that the recording power Pw at which the C/N reached the maximum value varies in relation to the decline of lines such as the lines of Tc=-10.times..lambda.d+300 and Tc=-10.times..lambda.d+240)

Detailed Description Text (18):
The stack structure of the magneto-optical recording medium of the present invention is not limited except that the metal reflecting layer is formed behind the magneto-optical recording layer or on the opposite side of the light-incident surface. For example, the metal reflecting layer may be formed on the magneto-optical recording layer directly or with a transparent dielectric layer between the metal reflecting layer and the magneto-optical recording layer. An inorganic protecting layer such as a transparent dielectric layer and/or an organic protecting layer such as an optically curable resin layer may be formed on the metal reflecting layer. The most preferred basic construction is a substrate / a first transparent dieletric layer / a magneto-optical recording layer / a second transparent dielectric layer / a metal reflecting layer.

Detailed Description Text (25):
As described above, the present invention resides in a combination of a metal reflecting layer having a certain heat sink characteristic and a magneto-optical recording layer having a certain Curie temperature and attains a magneto-optical recording medium in which a resistance to repeated recording and erasing and a resistance to continuous erasing are improved, and thus practically reliable.

Detailed Description Text (41):
Magneto-optical recording mediums having the construction shown in FIG. 1 were manufactured in the following manner. In FIG. 1, 1 denotes a substrate, 2 a first transparent dielectric layer, 3 a magneto-optical recording layer, 4 a second transparent dielectric layer, 5 a metal reflecting layer, and 6 an organic protecting

layer.

Detailed Description Text (50):
Examples 1 and 2 were repeated and magneto-optical recording discs were made, except that as the metal reflecting layer 5 an AlAuTi (91:7:2) layer (Example 3) or an AgAuTi (93:5:2) layer (Example 4) was deposited using a target of an Al or Ag disc with Au and Ti chips (5.times.5.times.1 mm) thereon and a pure 99.999% Ar gas by RF sputtering at a pressure of 0.67 Pa (5 mTorr), a power of 100 W and a frequency of 13.56 MHz. The samples had a .lambda.d of 3.0 .mu.W/K (Example 3) and a .lambda.d of 5.1 .mu.W/K (Example 4).

Detailed Description Text (56):
Examples 5 and 6 was repeated and magneto-optical recording discs were made, except that as the metal reflecting layer 5 an AlAuTi (91:7:2) layer 200 nm thick (Example 7) or an AgAuTi (93:5:2) layer 120 nm thick (Example 8) was deposited using a target of an Al or Ag disc (100 mm diameter and 5 mm thickness) with Au and Ti chips (5.times.5.times.1 mm) thereon and a pure 99.999% Ar gas by RF sputtering at a pressure of 0.67 Pa (5 mTorr), a power of 100 W and a frequency of 13.56 MHz. The samples of the magneto-optical recording mediums as shown in FIG. 1 had a .lambda.d of 4.0 .mu.W/K (Example 7) and a .lambda.d of 6.1 .mu.W/K (Example 8).

Detailed Description Text (58):
Examples 7 and 8 was repeated and magneto-optical recording discs as shown in FIG. 2 were made, except that the magneto-optical recording layer was replaced by two exchange coupled magnetic layers 3a and 3b.

Detailed Description Text (63):
Examples 1 and 2 were repeated to make magneto-optical recording mediums as shown in FIG. 1, except that the magneto-optical recording layer 3 was changed to a TbFeCo (22:68:10) alloy layer having a Tc of 210.degree. C. and the metal reflecting layer was changed to an AlTi (98:2) having a thickness of 40 nm (Comparative example 1) and an AgTi (98:2) having a thickness of 30 nm (Comparative example 2).

Detailed Description Text (66):
Example 1 was repeated to make a magneto-optical recording medium as shown in FIG. 1, except that the metal reflecting layer was changed to an AgAuTi (93:5:2) having a thickness of 60 nm.

Detailed Description Text (68):
Example 3 was repeated to make a magneto-optical recording medium as shown in FIG. 1, except that the magneto-optical recording layer 3 was changed to a TbFeCo alloy layer having a Tc of 190.degree. C. and a thickness of 20 nm by using a target of a TbFeCo (22:71:7) alloy disc and a pure 99.999% Ar gas and Rf sputtering at a pressure of 0.67 Pa (5 mTorr), a power of 100 W and a frequency of 13.56 MHz, and that the metal reflecting layer 5 was changed to an AlAuTi (91:7:2) having a thickness of 60 nm. The magneto-optical recording medium had a .lambda.d of 1.2 .mu.W/K.

Detailed Description Text (70):
Examples 2 and 6 were repeated to make magneto-optical recording mediums as shown in FIG. 1, except that the metal reflecting layer was changed to an Al layer having a thickness of 120 nm by using a target of an Al disc (100 mm diameter and 5 mm thick) and a pure 99.999% Ar gas and RF sputtering at a pressure of 0.67 Pa (5 mTorr), a power of 100 W and a frequency of 13.56 MHz. The metal reflecting layer 5 had a .lambda.d of 16.8 .mu.W/K and a magneto-optical recording layer was made of TbFeCo having a Tc of about 190.degree. C. (Comparative example 5) or NdDyTbFeCo having a Tc of about 150.degree. C. (Comparative example 6).

Other Reference Publication (2):
M.Birukawa et al. "Repeat Reading Stability in Magnet-optical Media", Optical Memory Symposium '90, Jul. 11. pp.65-66.

CLAIMS:

1. A magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first

dielectric layer and a metal reflecting layer on the magneto-optical recording layer, wherein said magneto-optical recording layer has a Curie temperature Tc of from 100.degree. C. to 200.degree. C. and a layer thickness of from 15 nm to 60 nm, said metal reflecting layer has a layer thickness of not less than 60 nm and a product .lambda.d of a thermal conductivity .lambda. by the layer thickness d of from 2.5 .mu.W/K to 20 .mu.W/K, and the following formula is satisfied: 10..lambda.d+160.ltoreq.Tc.ltoreq.-10..lambda.d+240.

2. A magneto-optical recording medium according to claim 1, wherein said magneto-optical recording layer has a Curie temperature of from 100.degree. C. to 180.degree. C.

3. A magneto-optical recording medium according to claim 2, wherein said magneto-optical recording layer has a Curie temperature of from 100.degree. C. to 160.degree. C.

4. A magneto-optical recording medium according to claim 1, wherein said magneto-optical recording layer comprises rare-earth and transition metal elements.

5. A magneto-optical recording medium according to claim 1, wherein said metal reflecting layer is an alloy containing at least one of AlAu and AgAu.

6. A magneto-optical recording medium according to claim 1, wherein said metal reflecting layer is one of AlAu and AgAu alloys containing at least one element selected from the group consisting of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Tc, Re, Ru, Os, Ir, Pt and Pd.

7. A magneto-optical recording medium according to claim 1, further comprising a second dielectric layer between said magneto-optical recording layer and said metal reflecting layer.

8. A magneto-optical recording medium according to claim 7, wherein said second dielectric layer has a layer thickness of from 15 nm to 40 nm.

9. A magneto-optical recording medium according to claim 8, wherein said second dielectric layer has a layer thickness of from 20 nm to 35 nm.

10. A magneto-optical recording medium according to claim 7, wherein said second dielectric layer is one of AlSiN and TaON.

11. A magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first dielectric layer and a metal reflecting layer on the magneto-optical recording layer, wherein said magneto-optical recording layer comprises first and second magnetic layers, the second magnetic layer being located on the side of metal reflecting layer, said first magnetic layer has a Curie temperature higher than that of said second magnetic layer, a coercive force at a room temperature lower than that of said second magnetic layer and a layer thickness thinner than that of said second magnetic layer, said second magnetic layer has a Curie temperature Tc.sub.2 of from 100.degree. C. to 180.degree. C., said magneto-optical recording layer has a total layer thickness of from 15 nm to 60 nm, said metal reflecting layer has a layer thickness of not less than 60 nm and a product .lambda.d of a thermal conductivity by the layer thickness of from 2.5 .mu.W/K to 20 .mu.W/K, and the following formula is satisfied: 10..lambda.d+160.ltoreq.Tc.sub.2 .ltoreq.-10..lambda.d+240.

12. A magneto-optical recording medium according to claim 11, wherein said second magnetic layer has a Curie temperature of from 100.degree. C. to 160.degree. C.

13. A magneto-optical recording medium according to claim 11, wherein said first and second magnetic layers comprise rare-earth and transition metal elements.

14. A magneto-optical recording medium according to claim 11, wherein said metal reflecting layer is an alloy containing at least one of AlAu and AgAu.

15. A magneto-optical recording medium according to claim 11, wherein said metal

reflecting layer is one AlAu and AgAu alloys containing at least one element selected from the group consisting of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W. Tc, Re, Ru, Os, Ir, Pt and Pd.

16. A magneto-optical recording medium according to claim 11, further comprising a second dielectric layer between said magneto-optical recording layer and said metal reflecting layer.

17. A magneto-optical recording medium according to claim 16, wherein said second dielectric layer has a layer thickness of from 15 nm to 40 nm.

18. A magneto-optical recording medium according to claim 17, wherein said second dielectric layer has a layer thickness of from 20 nm to 35 nm.

19. A magneto-optical recording medium according to claim 16, wherein said second dielectric layer is one of AlSiN and TaON.

20. A process for recording and storing information on a magneto-optical recording medium whereby stored information can be repeatedly erased and new information recorded while maintaining a high recording sensitivity and excellent resistance to repeated recording and erasing, which process comprises recording the information on a magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first dielectric layer and a metal reflecting layer on the magneto-optical recording layer, wherein said magneto-optical recording layer has a Curie temperature Tc of from 110.degree. C. to 180.degree. and a layer thickness of from 15 nm to 60 nm, said metal reflecting layer has a layer thickness of not less than 60 nm and a product .lambda.d of a thermal conductivity .lambda. by the layer thickness d of from 2.5 .mu.W/K to 20 .mu.W/K, and the following formula is satisfied:

-10.times..lambda.d+160.ltoreq.Tc.ltoreq..times..lambda.d+240.

21. A process for recording and storing information on a magneto-optical recording medium whereby stored information can be repeatedly erased and new information recorded while maintaining a high recording sensitivity and excellent resistance to repeated recording and erasing, which process comprises recording the information on a magneto-optical recording medium comprising a transparent substrate, a first dielectric layer on the substrate, a magneto-optical recording layer on the first dielectric layer and a metal reflecting layer on the magneto-optical recording layer, wherein said magneto-optical recording layer comprises first and second magnetic layers, the second magnetic layer being located on the side of metal reflecting layer, said first magnetic layer has a Curie temperature higher than that of said second magnetic layer, a coercive force at a room temperature lower than that of said second magnetic layer and a layer thickness thinner than that of said second magnetic layer, said second magnetic layer has a Curie temperature Tc.sub.2 of from 110.degree. C. to 180.degree. C., said magneto-optical recording layer has a total layer thickness of from 15 nm to 60 nm, said metal reflecting layer has a layer thickness of not less than 60 nm and a product .lambda.d of a thermal conductivity by the layer thickness of from 2.5 .mu.W/K to 20 .mu.W/K, and the following formula is satisfied:

-10.times..lambda.D+160.ltoreq.Tc.sub.3 .ltoreq.x.lambda.d+240.

WEST

Generate Collection | Print

L12: Entry 35 of 73 File: USPT Apr 14, 1998

DOCUMENT-IDENTIFIER: US 5738947 A
TITLE: Corrosion-resistant film for protecting surfaces of Ag and corrosion-resist composite structures

Abstract Text (1):
Disclosed is a corrosion-resistant film for protecting the surfaces of Ag, which comprises an Ag--Mg alloy having an Mg content of from 1 to 10 atomic % and which is applied to an Ag substrate. Also disclosed is a corrosion-resistant composite structure composed of an Ag substrate and a protective film of an Ag--Mg alloy with an Mg content of from 1 to 10 atomic % formed on the surface of the Ag substrate. The corrosion-resistant film protects an Ag with a silver-white gloss from being blackened by sulfide components, etc. The adhesiveness between the film and the Ag substrate is good. The composite structure has a high reflectivity and is useful as a reflective film for photo-magnetic recording media, optical recording media, reflectors, illuminators, etc. The surface of the corrosion-resisting film is oxidized to form an MgO layer on the film, and the film exhibits a high protecting effect.

Brief Summary Text (3):
The present invention relates to a corrosion-resistant film for protecting surfaces of silver (Ag), with protection from being corroded by ozone, sulfide components, etc. in air, to a composite structure composed of a Ag substrate and the above-mentioned corrosion-resistant film, which is used as a reflective film, for example, for a photo-magnetic recording medium, an optical recording medium, a reflector, an illuminator, a sign, etc. and as a plating film, for example, for a metal product, a plastic product, etc, and to a method of protecting an Ag surface from corrosion from sulfide components and ozone in air.

Brief Summary Text (5):
Ag is an extremely useful metal, having a beautiful silver-white gloss and excellent ductility and malleability and having the largest electric conductivity and thermal conductivity in the group of metals. In particular, since Ag has a reflectivity of almost 100% against visible rays in a broad wavelength range, it is widely used as a reflective film for various devices needing mirror surfaces, such as in optical recording media, etc. If tableware is plated with Ag, they have improved outward appearance and microorganisms in water attached to them are killed. Ag-plated utensils have a high-quality feel and their commercial value is elevated.

Brief Summary Text (11):
Another object of the present invention is to provide a composite structure composed of an Ag substrate and a corrosion-resistant film which can favorably used as a reflective film, for example, for a photo-magnetic recording medium, an optical recording medium, a reflector, an illuminator, a sign, etc. and as a plating film, for example, for a metal product, a plastic product, etc.

Drawing Description Text (5):
FIG. 3 is a perspective view showing the structure of a compact disc, a kind of optical disc of one embodiment of the present invention.

Drawing Description Text (15):
In these drawings, 16a is an Ag film; 16b is an Ag--Mg alloy film; 16 is a reflective layer of a photomagnetic disc; 21 is a reflective layer of an optical disc; 32 is a

reflective layer of a mirror; 44 is a reflective layer of an illuminator; 52 is a plated film of a cosmetic container.

Detailed Description Text (5):
The present invention also provides a reflective film comprising the above-mentioned composite structure. Such a reflective film is used in, for example, photomagnetic recording media, optical recording media, reflectors, illuminators, various signs, etc.

Detailed Description Text (8):
In another embodiment of the reflective film of the present invention for optical recording media, it is desirable that the protective film is made of an Ag--Mg alloy containing from 1 to 5 atomic % of Mg.

Detailed Description Text (25):
The composite structure of the present invention is comprised of an Ag substrate and a protective film of an Ag--Mg alloy, such as that mentioned hereinabove, formed on the substrate. As examples of the composite structure, mentioned are reflective films for photo-magnetic recording media, optical recording media, reflectors, illuminators, various signs, etc., and plating films for plastic products. In the composite structure of this type, in general, it is desirable that a protective film having a thickness of 50 .ANG. or more is formed on an Ag substrate having a thickness of 500 .ANG. or more, preferably 1,000 .ANG. or more. If the thickness of the Ag substrate is less than 500 .ANG., there is a probability that the composite structure could not have the desired gloss and reflectivity. The preferred range of the thickness of the protective film varies in some degree, depending on the use of the film, as will be mentioned hereinunder.

Detailed Description Text (28):
Where the reflective film of the present invention is used as a reflective film for optical recording media, such as optical discs (CD), optical cards, etc., it is desirable that the protective film is made of an Ag--Mg alloy to be formed by incorporating from 1 to 5 atomic % of Mg into Ag. The reason is because the reflectivity of the alloy film shall be 90% or more.

Detailed Description Text (29):
FIG. 3 shows an embodiment of the present invention where the reflective film of the invention has been applied to an optical disc. In this drawing, a reflective film 21 has been laminated on a transparent plastic substrate board 22, and the film 21 has been coated with a protective film 23. The reflective film 21 is made of the composite structure of the invention, which is composed of an Ag film and an Ag--Mg alloy film formed on the Ag film. The Ag--Mg alloy film is made of an Ag--Mg alloy containing from 1 to 5 atomic % of Mg, and its thickness is suitably 50 .ANG. or more. The thickness of the Ag is film is suitably 500 .ANG. or more. The protective film may be made of SiAlON, Si.sub.3 N.sub.4 or the like.

Detailed Description Text (44):
At the intended final vacuum degree of 5.times.10.sup.-7 Torr, Ar gas is introduced into the chamber by which the vacuum degree is made 1.times.10.sup.-3 Torr, and the sputtering is started. The temperature of the substrate board is set am room temperature (25.degree. C..+-.3.degree. C.), and an Ag film is formed on the substrate board at a predetermined thickness, for example, 1,000 .ANG.. Next, as shown in FIG. 8, the substrate board is reset between the Ag target and the Mg target. In this situation, .theta. is from 0 to 40.degree. in FIG. 10. While resetting the substrate board, the shutter above the Mg target is removed. In this way, the condition of the position of the substrate board and the shutter are varied at the same time. Subsequently, an Ag--Mg film is formed on the Ag film on the substrate board at a predetermined thickness, for example, 50 .ANG.. The composition of the Ag--Mg alloy film thus formed contains, for example, 2.4 atomic % of Mg when .theta.=20.degree.. Where the Ag--Mg alloy film thus formed is desired to be oxidized, the thus-coated substrate board is, without being kept as it is immediately heated at a high temperature and at a high humidity or at a high temperature and at a high humidity under high pressure. Alternatively, the thus-coated substrate board is, without being exposed to air, heated in the presence of O.sub.2 in the sputtering chamber. The concentration of O.sub.2 is selected so as to produce the desired MgO

film, under the chosen time and reaction conditions.

Detailed Description Text (48):
At the intended final vacuum degree of 5.times.10.sup.-7 Torr, Ar gas is introduced into the chamber by which the vacuum degree is made 1.times.10.sup.-3 Torr, and the sputtering is started. The temperature of the substrate board is set at room temperature (25.degree. C..+-.3.degree. C.), and an Ag film is formed on the substrate board at a predetermined thickness, for example, 1,000 .ANG.. Next, as shown in FIG. 9, the substrate is reset above the Ag--Mg target. In this situation, .theta. is from 120.degree. in FIG. 10. While resetting the substrate, the shutter above the Ag--Mg target is reset above the Ag target. In this way, the condition of the position of the substrate board and the shutter are varied at the same time. Subsequently, an Ag--Mg film is formed on the Ag film on the substrate board am a predetermined thickness, for example, 50 .ANG.. The composition of the Ag--Mg alloy film thus formed contains, for example, 2.4 atomic % of Mg when the Ag--Mg target contains 5.0 atomic % of Mg. Where the Ag--Mg alloy film thus formed is desired to be oxidized, the thus-coated substrate board is, without being kept as it is, immediately heated at a high temperature and at a high humidity or at a high temperature and at a high humidity under high pressure. Alternatively, the thus-coated substrate board is, without being exposed to air, heated in the presence of O.sub.2 in the sputtering chamber.

Detailed Description Text (58):
As has been described in detail hereinabove, the present invention provides a protective film of an Ag--Mg alloy having an Mg content of from 1 to 10 atomic % which is used to protect an Ag substrate. The surface of the protective film is oxidized to form an Mg oxide film thereon, and the protective film with such an Mg oxide film on its surface effectively acts to protect the underlying Ag substrate from being corroded by ozone and sulfides in air. The reflectivity of the Ag substrate coated with the protective film is not substantially lowered. The adhesiveness between the Ag substrate and the protective Ag--Mg alloy film is good. The composite structure composed of the Ag substrate and the protective Ag--Mg alloy film may be applied to any conventional substrate board or under-layer and the adhesiveness between the composite structure and the substrate board or under-layer is good. Therefore, the present invention also provides such composite structure which is useful, for example, as a reflective film for photo-magnetic recording media, optical recording media, reflectors, illuminators, signs, etc. or as a plating film for plastic produces, etc.

CLAIMS:

10. An optical recording medium comprising a corrosion-resistant composite which comprises: i) an Ag substrate; and ii) a protective film of an Ag--Mg alloy with an Mg content of from 1 to 5 atomic % formed on the surface of said Ag substrate, prepared by a process of

oxidizing a surface part of said protective film of said Ag--Mg alloy to form an MgO layer on an external surface of said protective film wherein Mg is diffused from a surface of said Ag--Mg alloy opposite to an interface between said Ag surface and said Ag--Mg alloy

wherein said protective film has a thickness of 50 .ANG. or more.

WEST

Generate Collection | Print

L13: Entry 40 of 43 File: JPAB Apr 25, 1995

PUB-NO: JP407110964A
DOCUMENT-IDENTIFIER: JP 07110964 A
TITLE: OPTICAL RECORDING MEDIUM

PUBN-DATE: April 25, 1995

INVENTOR-INFORMATION:

NAME	COUNTRY
UEMATSU, TAKUYA	
IMAMURA, SATORU	
SEKI, YOSHINORI	
KURIWADA, TAKESHI	

ASSIGNEE-INFORMATION:

NAME	COUNTRY
MITSUBISHI CHEM CORP	

APPL-NO: JP05277809
APPL-DATE: October 8, 1993

INT-CL (IPC): G11 B 7/24

ABSTRACT:

PURPOSE: To obtain an optical recording medium whose recording power margin is wide, whose recording linear-velocity dependence is small and which is suitable for a recordable compact disk.

CONSTITUTION: An optical recording medium is formed in such a way that a light-absorbing layer containing an organic pigment, a light-reflecting layer composed of a metal and a protective layer are laminated sequentially on a transparent substrate. The light-reflecting layer is featured in such a way that it is a silver polycrystal thin film at I200/I111≤0.2 when its X-ray diffraction intensity by a 111 plane is designated as I111 and its X-ray diffraction intensity by a 200 plane is designated as I200 in an X-ray diffraction spectrum measured by a θ-2θ method while an angle of incidence with reference to the face of the substrate is set at θ.

WEST

Generate Collection Print

L13: Entry 41 of 43 File: JPAB Nov 25, 1992

PUB-NO: JP404337534A
DOCUMENT-IDENTIFIER: JP 04337534 A
TITLE: OPTICAL RECORDING MEDIUM

PUBN-DATE: November 25, 1992

INVENTOR-INFORMATION:

NAME	COUNTRY
MURAKAMI, SHINICHI	
SASAGAWA, TOMOYOSHI	
KOIKE, MASASHI	
HIROSE, SUMIO	

ASSIGNEE-INFORMATION:

NAME	COUNTRY
MITSUI TOATSU CHEM INC	

APPL-NO: JP03107029
APPL-DATE: May 13, 1991

US-CL-CURRENT: 369/283
INT-CL (IPC): G11B 7/24; B41M 5/26

ABSTRACT:

PURPOSE: To enhance the interchangeability with a reproduction-only CD and to enhance the adhesion of a reflection layer by providing the reflection layer consisting of an Au film having a specific value or below of the half value width of prescribed peaks in X-ray diffraction.

CONSTITUTION: The DRAW type CD is formed by successively laminating a recording layer 2, the reflection layer 3 and a protective layer 4 on an injection- molded substrate 1 consisting of polycarbonate. The layer 3 is formed of a metallic film essentially consisting of the Au having ≤0.90° half value width of the 1, 1, 1 peaks in X-ray diffraction and ≥1 kinds among Ag, Al and Cu may be incorporated as side components into this film. A phthalocyanine dye (e.g.: compd. of formula) is preferably used for the layer 2 and the layer can be formed by a spin coating method, etc. The layer 4 can be formed of a UV curing acrylic resin.

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平4－337534

(43)公開日　平成4年(1992)11月25日

(51)Int.Cl.[5]	識別記号	庁内整理番号	F I	技術表示箇所
G11B　7/24	536	7215－5D		
B41M　5/26				
		8305－2H	B41M　5/26	W

審査請求　未請求　請求項の数3（全 6 頁）

(21)出願番号　特願平3－107029

(22)出願日　平成3年(1991)5月13日

(71)出願人　000003126
三井東圧化学株式会社
東京都千代田区霞が関三丁目2番5号

(72)発明者　村上　慎一
神奈川県横浜市栄区笠間町1190番地　三井東圧化学株式会社内

(72)発明者　笹川　知由
神奈川県横浜市栄区笠間町1190番地　三井東圧化学株式会社内

(72)発明者　小池　正士
神奈川県横浜市栄区笠間町1190番地　三井東圧化学株式会社内

最終頁に続く

(54)【発明の名称】　光記録媒体

(57)【要約】
【構成】　透明基板上に有機色素からなる記録層を設け、その上にX線回折における（1，1，1）ピークの半値幅が0．90度以下であるＡｕ反射層を設け、さらにその上に保護層を設けた追記型コンパクトディスク（CD）。
【効果】　本発明の追記型ＣＤは記録後、再生専用ＣＤと高い互換性をもち、市販のＣＤプレーヤーで良好に再生可能である。また、この追記型ＣＤのＡｕ膜は色素層との密着性が良好である。

1

【特許請求の範囲】

【請求項1】　反射層が、X線回折における（1，1，1）ピークの半値幅が0．90度以下であるAuを主成分とする金属膜よりなる光記録媒体。

【請求項2】　基板上に記録層、反射層、および保護層がこの順に設けられた請求項1記載の光記録媒体。

【請求項3】　上記記録層がフタロシアニン色素よりなる請求項2記載の光記録媒体。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、光記録媒体、特に金属反射層を有する光記録媒体の特性に関する。

【0002】

【従来の技術】近年の急速な情報化社会の進展に伴い、磁気記録媒体に比べ格段に高密度記録が可能な光記録媒体の利用・研究が盛んに行われている。この光記録媒体としては、あらかじめ情報が記録されており再生のみが可能な再生専用型、利用者によって情報の記録および再生が可能な追記型、および情報の記録・再生・消去が可能な書換え型が知られている。なかでも追記型は、書換え型よりも一般に安価で保存性に優れるため、大量のデータをコンパクトに保存しておく媒体として広く普及しつつある。この追記型の光記録媒体は、Te、Biなどの金属膜や、シアニン、フタロシアニンなどの色素膜等を基板上に記録層としてもっており、レーザー光を照射してこの記録層に物理的および／あるいは化学的変化を起こさせてピットを形成することによって情報を記録し、このピットを記録時よりも十分に弱いレーザー光によって読みだして再生を行うものである。このような光記録媒体では、ピット形成を容易にするため記録層上に空間を確保するのが一般的である。具体的には、記録層をもった基板2枚を、記録層が対向しかつ2枚の基板の間に空隙ができるように貼り合わせた、いわゆるエアサンドイッチ構造がとられる。

【0003】一方、再生専用型の光記録媒体が、コンパクトディスク（CD）やレーザーディスクなどとして広く一般に普及しているのは周知の通りである。この光記録媒体の構造を図1に示す。すなわち、あらかじめ基板1にピットを形成しておき、そのピット形成面にAu、Al等の金属層を反射層3として設け、さらにその上に保護層4を形成したものである。なかでもCDは、これまでの音楽レコードに比べ取り扱いやすく半永久的に使用できるという利点から、わが国においてはレコードにとって代わりつつある。このようにCDが広く利用されるにつれて、このCDの再生装置であるコンパクトディスクプレーヤー（CDプレーヤー）もレコードプレーヤーに肩を並べるほど広く普及している。このようにきわめて広く普及しているCDは、一般にスタンパーと呼ばれる原盤をもとにして射出成形によって情報ピットをもつ基板を作製する。この方法では同じCDを大量にかつ

2

安価に製造することは容易であるが、スタンパーが高価なため、小量のCDを作製することには向いていない。また当然のことながら、CDは再生専用であるため、利用者が自由に音楽や情報を記録することは不可能である。そこで、小量のCDを安価に作製するため、あるいは利用者が自由に記録を行うための、記録可能なCD（追記型CD）の開発が盛んに行われている。最近、実用化された追記型CDが発表された（日経エレクトロニクスNo．465，107項，1989年1月23日発行）。この追記型CDは、図2に示すような構造になっている。すなわち、基板1上に記録層2を設け、その上に反射層3を設けて、さらにその上に保護層4を設けた単板型の光記録媒体である。このような構造にすることによって、記録後の追記型CDが通常の再生専用CDと互換性をもつことが可能になる。すなわち、エアサンドイッチ型構造ではなく単板型構造にすることによってその厚さを1．2mmという薄さにすることが可能になる。また、半導体レーザー波長でAlよりも反射率が高いAuを反射層として設けることにより、再生専用CDと同等の反射率を獲得することが可能となるのである。

【0004】

【発明が解決しようとする課題】重要なことは、このような追記型CDは、記録後は再生専用CDと高い互換性があり、現在広く普及している市販CDプレーヤーすべてで再生できる必要があることである。この点で、上記の発表された追記型CDは、記録後に市販CDプレーヤーで再生可能であるとされているが、本発明者らが詳細に検討したところによれば、その性能は完全に満足できるものではなく、一部のCDプレーヤーで再生不能の場合があることがわかった。この原因は現在のところ十分解明されていないが、次のような事がその原因の一つとして考えられる。すなわち、反射層として用いたAuの反射率が十分でないため、低反射率に対するマージンが少ない一部のCDプレーヤーで再生不良を起こすのではないかと推定される。また、Auは一般に下地との密着性がよくないため反射層が剥離しやすいという問題があることもわかった。もし、このような剥離が起こった場合、追記型CDにおいては信号の記録・再生が不可能になり、重大な問題を引き起こすことになる。

【0005】

【課題を解決するための手段】本発明者らは、上記課題を解決すべく鋭意研究を重ねた結果、意外なことに反射層のAuの結晶性が記録後の媒体の再生専用CDとの互換性、ならびにAu反射層の密着性に大きく影響していることを見いだした。本発明はかかる知見によりなされるに至ったものである。すなわち、本発明にかかる光記録媒体は、以下のようなものである。（1）反射層が、X線回折における（1，1，1）ピークの半値幅が0．90度以下であるAuを主成分とする金属膜よりなる光記録媒体であり、好ましくは、（2）基板上に記録層、

反射層、および保護層がこの順に設けられた光記録媒体、であり、更に好ましくは、（3）上記記録層がフタロシアニン色素よりなる光記録媒体、である。

【0006】本発明の光記録媒体の構成は図2に示した追記型CDと基本的に同一である。すなわち、必要に応じてプリグルーブ（案内溝）を形成した透明な基板1の上にレーザー光を吸収してピットを形成する記録層2が設けられており、その記録層の上に反射率を増大させるための反射層3が設けられており、さらにその上に好ましくは記録層および反射層を保護するための保護層4が設けられているものである。上記基板の材質としては、半導体レーザーの光を実質的に透過し、通常の光記録媒体に用いられる材料ならばいかなるものも使用できる。たとえば、ポリカーボネート樹脂、アクリル樹脂、ポリスチレン樹脂、塩化ビニル樹脂、エポキシ樹脂、ポリエステル樹脂、アモルファスポリオレフィンなどの高分子材料、あるいはガラスなどの無機材料等を利用できる。必要に応じて、これらの材料を射出成形によって、あるいは2P法などによってプリグループを形成した基板とする。記録層は記録レーザー光を吸収して物理的あるいは／かつ化学的変化を起こし、これが再生レーザー光で読み取り可能であるような物質であれば特に限定されない。たとえば、以下のような半導体レーザー波長域に吸収を有する各種の有機色素を用いることができる。すなわち、フタロシアニン系色素、ナフタロシアニン系色素、シアニン系色素、スクワリリウム系色素、ピリリウム系色素、チオピリリウム系色素、アズレニウム系色素、ナフトキノン系色素、アントラキノン系色素、Ni，Crなどの金属塩系色素、インドフェノール系色素、トリフェニルメタン系色素、キサンテン系色素、インダンスレン系色素、インジゴ系色素、チオインジゴ系色素、メロシアニン系色素、チアジン系色素、アクリジン系色素、オキサジン系色素、アゾ系色素などを挙げることができる。なかでも、フタロシアニン系色素はその高い耐光性・耐久性、ならびにその吸収波長域から特に好ましいものである。このようなフタロシアニン系色素は、たとえば特開平3－62878などに記載の方法で(incorporated herein by reference)合成可能である。

【0007】これらの色素は単独で用いてもよいし、2種類以上の色素を混合して用いてもよい。また、必要に応じて紫外線吸収剤、一重項酸素クエンチャー、結合剤等の添加物質を加えることもできる。　これらの物質を、上記基板上に均一な膜として成膜し、記録層を形成させる。このとき、反射膜を形成後に十分な反射率が得られるように、あらかじめ記録層の膜厚および光吸収成分の濃度を調整する。この記録層を形成する方法としては、スピンコート法、ディップコート法、バーコート法などの塗布法を用いることができる。これは、記録層として用いる物質を溶剤に溶解して塗布液を調整し、これを上記基板上に塗布後、乾燥して成膜するものである。このときの溶剤としては、以下のような各種有機溶剤が利用可能である。すなわち、n－ヘキサン、n－オクタン、イソオクタン、シクロヘキサンなどの脂肪族炭化水素；トルエン、キシレンなどの芳香族炭化水素；1，2－ジクロロエタン、クロロホルムなどのハロゲン化炭化水素；メタノール、エタノール、イソプロパノールなどのアルコール；ジエチルエーテル、ジブチルエーテル、ジオキサンなどのエーテル；メチルセロソルブ、エチルセロソルブなどのセロソルブ；メチルエチルケトン、シクロヘキサノンなどのケトン；酢酸エチル、酢酸ブチルなどのエステル；2，2，3，3－テトラフルオロプロパノールなどのフッ素化アルコールなどを用いることができる。これらの有機溶剤は単独で用いてもよいし、混合して用いてもよい。また、これらの溶剤を用いる場合、記録層として用いる物質を溶解するだけでなく、このとき用いる基板に対してダメージを与えないものを選択する必要があることは言うまでもない。

【0008】記録層を形成する方法として、真空蒸着法も用いることができる。これは真空槽内に記録層として用いる物質と基板を所定の配置にセットして、十分な真空下で記録層物質を加熱蒸発させて基板上に成膜するものである。この方法は記録層物質の溶剤への溶解性が低く、記録層物質を溶解しかつ基板にダメージを与えない溶剤が選択できない場合に有効である。記録層の膜厚は、通常30～500 nm程度である。上記記録層と上記基板との間に、塗布溶剤に対する耐性を向上させるため、記録層の劣化防止などのため各種の下地層を設けることも可能である。この下地層としては、たとえば、ポリカーボネート、ポリメタクリル酸メチル、ポリスチレンなどの高分子物質、SiO_2、SnO_2、Al_2O_3、AlNなどの無機物を用いることができる。これらは、単独で用いてもよいし、混合して用いてもよい。また、多層膜として2種以上を重ねて使用しても構わない。

【0009】上記記録層上には、Auを主成分とする反射層を形成するが、本発明においては、この反射層のX線回折を測定したとき、その（1，1，1）ピークの半値幅が0．90度以下、より好ましくは0．80度以下である必要がある。この半値幅が0．90度を越えるようなAu層を反射層として用いた場合、再生専用CDと互換性がとれる追記型CDを製造することが困難になってしまうことを本発明者らは見出した。また、このとき反射層の密着性が悪化し、反射層が剥離しやすくなってしまう。万が一、このような剥離が起こった場合、信号の記録・再生が不可能になり重大な問題を引き起こす。本発明におけるX線回折の（1，1，1）ピークの半値幅が0．90度以下であるAuを主成分とする反射層は、その成膜時の条件を適切にコントロールすることによって作製可能である。たとえば、真空蒸着法によりこのような反射層を形成する場合、その成膜速度、真空

度、被蒸着物の温度などをコントロールすることによって、この半値幅を0．90度以下にすることができる。例えば、その指針としては、一般に、成膜速度を遅くすれば、ピークはシャープになる。また真空度を上げるほど、被着物質の温度を高くするほど、シャープなピークが得られることを考慮すればよい。もちろん、スパッタ法などの他の成膜法を用いる場合も、同様である。

【0010】本発明の反射層は純粋なＡｕのみからなっていてもよいし、他の元素を１種類あるいは２種類以上副成分として含んでいてもよい。この副成分元素としては、たとえば、Ａｇ，Ａｌ，Ｃｕ，Ｃｒ，Ｎｉ，Ｓｉ，Ｇｅ等を挙げることができる。これらの副成分元素の総量は反射層を形成する全原子数の５０％未満であればいかなる割合で用いてもよい。記録層の膜厚は、通常30～500 nm程度である。この記録層と反射層の間に、反射率を向上させるため、記録層と反射層の間の接着力を向上させるため等の目的で中間層を設けることもできる。この中間層として用いることができる物質の例としては、ポリカーボネート、ポリメタクリル酸メチル、ポリスチレンなどの高分子物質、SiO_2、SnO_2、Al_2O_3、ＡｌＮなどの無機物、シランカップリング剤などを挙げることができる。これらは、単独で用いてもよいし、混合して用いてもよい。また、多層膜として２種以上を重ねて使用しても構わない。

【0011】反射層上には、保護層を設ける。この保護層は記録膜および反射膜を保護できるものならば特に限定されない。たとえば、ポリカーボネート、アクリル、ポリスチレン、塩化ビニル、エポキシ、ポリエステルな＊＊どの高分子材料、あるいはＳｉO2、Ａｌ2O3、ＡｌＮなどの無機物を用いることができる。なかでも、紫外線硬化アクリル樹脂は、容易に保護層を形成できるので好適である。これらは、単独で用いてもよいし、混合して用いてもよい。また、多層膜として２種以上を重ねて使用しても構わない。保護層の膜厚は通常１～15μm 程度である。

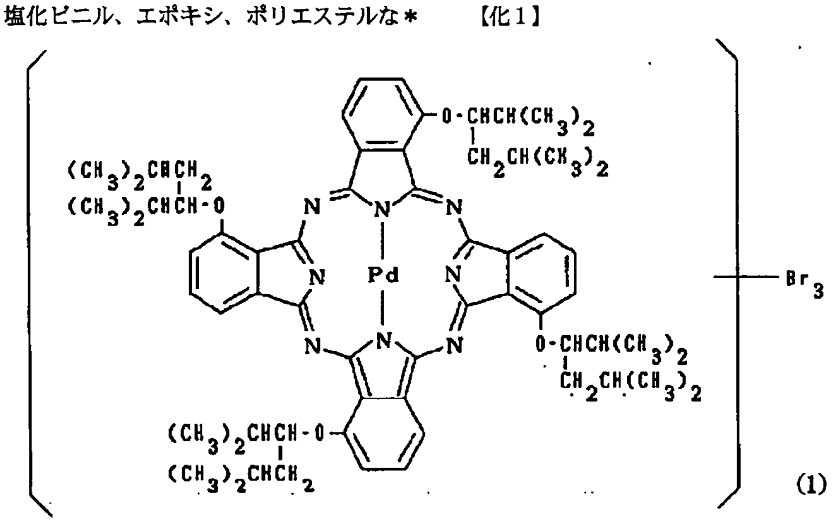
【0012】

【実施例】以下本発明の実施例を示す。

［実施例１］フタロシアニン色素〔化１〕式(1) ０．６２ｇをｎ－オクタン２０ｍｌに溶解し、塗布溶液を調製した。この溶液をスパイラルグルーブ付きのポリカーボネート製射出成形基板（外径１２０mm、厚さ１．２mm、トラックピッチ１．６μm、溝幅０．５２μm、溝深さ０．１２μm）上に回転数１３００ｒｐｍでスピンコートした後、５０℃で真空乾燥し、記録層を形成した。次に、真空蒸着装置ＳＧＣ－８ＭＩＩ（昭和真空（株）製）を用いて、成膜速度０．０６nm／ｓ、真空度８．０×１０-6Ｔｏｒｒ、基板温度４０℃という条件で、上記記録層上に厚さ９０ｎｍの純粋なＡｕ膜を形成した。さらにこの反射層上に紫外線硬化樹脂ＳＤ－１７（大日本インキ化学工業（株）製）をスピンコート後、紫外線を照射し硬化させ、厚さ４μmの保護層を形成した。また、反射層上に保護層を設けないサンプルも作製し、この反射層のＸ線回折を測定したところ、その（1，1，1）ピークの半値幅は０．７６度であった。

【0013】

【化１】



(1)

【0014】このようにして作製した光記録媒体に、光ディスク評価装置ＤＤＵ－１０００（パルステック工業製、レーザー波長７８１ｎｍ）およびＥＦＭエンコーダー（ＫＥＮＷＯＯＤ（株）製）を用いて、線速度１．３ｍ／ｓ・記録レーザーパワー７ｍWで記録した。記録後の媒体を市販ＣＤプレーヤー８種で再生したところ、すべてのＣＤプレーヤーで良好に再生可能であった。また、この記録媒体の記録後の反射率（ＥＦＭ信号の最大値）は７２％と高い値であった。さらに、粘着テープ（Ｓｃｏｔｃｈ　８１０）を用いて、この媒体の剥離試験を行ったが、反射膜の剥離は観測されなかった。

【0015】［比較例１］実施例１において、真空蒸着時の条件を、成膜速度０．１５nm／ｓ、真空度２．４×１０-5Ｔｏｒｒ、基板温度３８℃としたこと以外は実

施例1と同様にして光記録媒体を作製し、信号を記録した。この比較例においても、反射層上に保護層を設けないサンプルも作製し、この反射層のX線回折を測定したところ、その（1，1，1）ピークの半値幅は0．94度であった。この記録後の光記録媒体を実施例1で用いた8種の市販CDプレーヤーで再生したところ、2種類のCDプレーヤーで再生不良を起こした。また、この光記録媒体の記録後の反射率は63％であった。さらに、実施例1と同様に剥離試験を行ったところ、反射膜と記録膜の間で剥離し、粘着テープとともに反射膜および保護膜が剥がれてしまった。

【0016】［実施例2］シアニン色素NK529（日本感光色素（株）製）0．31gおよびシアニン色素NK2929（日本感光色素（株）製）0．10gをメチルセロソルブと2，2，3，3－テトラフルオロプロパノールの2：1混合溶媒10mlに溶解し、塗布溶液を調製した。この溶液をスパイラルグルーブ付きのポリカーボネート製射出成形基板（外径120mm、厚さ1．2mm、トラックピッチ1．6μm、溝幅0．61μm、溝深さ0．15μm）上に回転数1000rpmでスピンコートした後、50℃で真空乾燥し、記録層を形成した。次に、真空蒸着装置SGC－8MII（昭和真空（株）製）を用いて、成膜速度0．10nm／s、真空度1．1×10-5Torr、基板温度42℃という条件で、上記記録層上に厚さ80nmの純粋なAu膜を形成した。さらにこの反射層上に紫外線硬化樹脂SD－17（大日本インキ化学工業（株）製）をスピンコート後、紫外線を照射し硬化させ、厚さ6μmの保護層を形成した。また、反射層上に保護層を設けないサンプルも作製し、この反射層のX線回折を測定したところ、その（1，1，1）ピークの半値幅は0．77度であった。＊

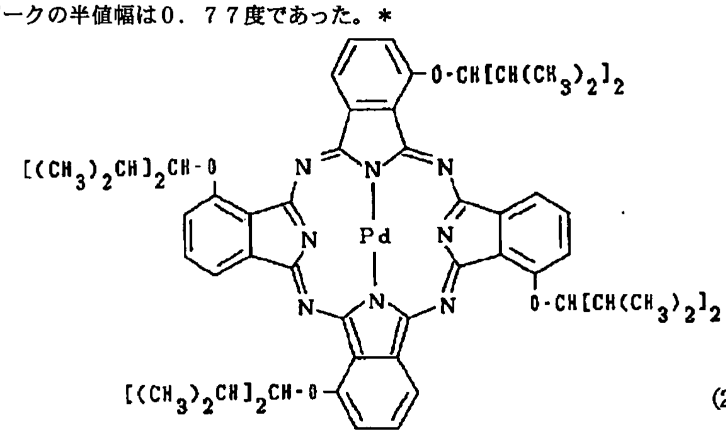
＊このようにして作製した光記録媒体に、記録レーザーパワー8．0mWで実施例1と同様にして記録した。この記録後の光記録媒体を実施例1で用いた8種の市販CDプレーヤーで再生したところ、すべてのCDプレーヤーで良好に再生可能であった。また、この光記録媒体の記録後の反射率は75％であった。

【0017】［比較例2］実施例2において、真空蒸着時の条件を、成膜速度0．17nm／s、真空度3．3×10-5Torr、基板温度41℃としたこと以外は実施例2と同様にして光記録媒体を作製し、信号を記録した。この比較例においても、反射層上に保護層を設けないサンプルも作製し、この反射層のX線回折を測定したところ、その（1，1，1）ピークの半値幅は0．98度であった。この記録後の光記録媒体を実施例1で用いた8種の市販CDプレーヤーで再生したところ、1種類のCDプレーヤーで再生不良を起こした。また、この光記録媒体の反射率は64％であった。

【0018】［実施例3］実施例1において、フタロシアニン色素を〔化2〕式(2) にし、真空蒸着時の条件を、成膜速度0．10nm／s、真空度1．1×10-5Torr、基板温度41℃としたこと以外は実施例1と同様にして光記録媒体を作製し、信号を記録した。この実施例においても、反射層上に保護層を設けないサンプルも作製し、この反射層のX線回折を測定したところ、その（1，1，1）ピークの半値幅は0．78度であった。この記録後の光記録媒体を実施例1で用いた8種の市販CDプレーヤーで再生したところ、すべてのCDプレーヤーで良好に再生可能であった。

【0019】

【化2】



(2)

【0020】［比較例3］特開平3－62878の実施例98と全く同様にして、フタロシアニン色素〔化2〕をポリカーボネート基板上に塗布し、その上にAuをスパッタし、UV硬化樹脂を塗布硬化して光記録媒体を作製した。このときのAu膜のX線回折を測定したところ、その（1，1，1）ピークの半値幅は0．92度であった。この光記録媒体に実施例1と同様にして信号を記録し、この記録後の光記録媒体を実施例1で用いた8種の市販CDプレーヤーで再生したところ、2種類のCDプレーヤーで再生不良を起こした。

【0021】

【発明の効果】以上説明した通り、本発明によれば、再生専用CDと高い互換性をもち、かつ密着性のよいAuを主成分とする反射層をもつ光記録媒体を提供すること

が可能である。

【図面の簡単な説明】

【図１】再生専用ＣＤの断面図である。

【図２】追記型ＣＤの１例を示す断面図である。

【符号の説明】

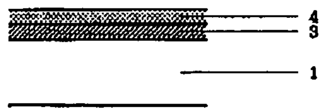
1　基板

2　記録層

3　反射層

4　保護層

【図１】



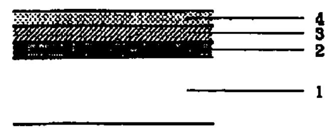
〔符号の説明〕

1　基板

3　反射層

4　保護層

【図２】



〔符号の説明〕

1　基板

2　記録層

3　反射層

4　保護層

フロントページの続き

(72)発明者　広瀬　純夫
神奈川県横浜市栄区笠間町1190番地　三井東圧化学株式会社内